Update on track reconstuction efficiency in jets

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- Tuning the embedded MC track
  - Hit merging
  - Hit efficiency
- Results (for low p_t tracks)
- Plan

Tuning the embedded MC track

- Embedded tracks must be tuned to emulate data tracks in jets
  - Distribution of number of axial and stereo hits attached to track:
  - Hit merging: hit merge distance 20ns
  - Hit efficiency:

    $\Rightarrow$ Numerator: measure hit efficiency in cosmics

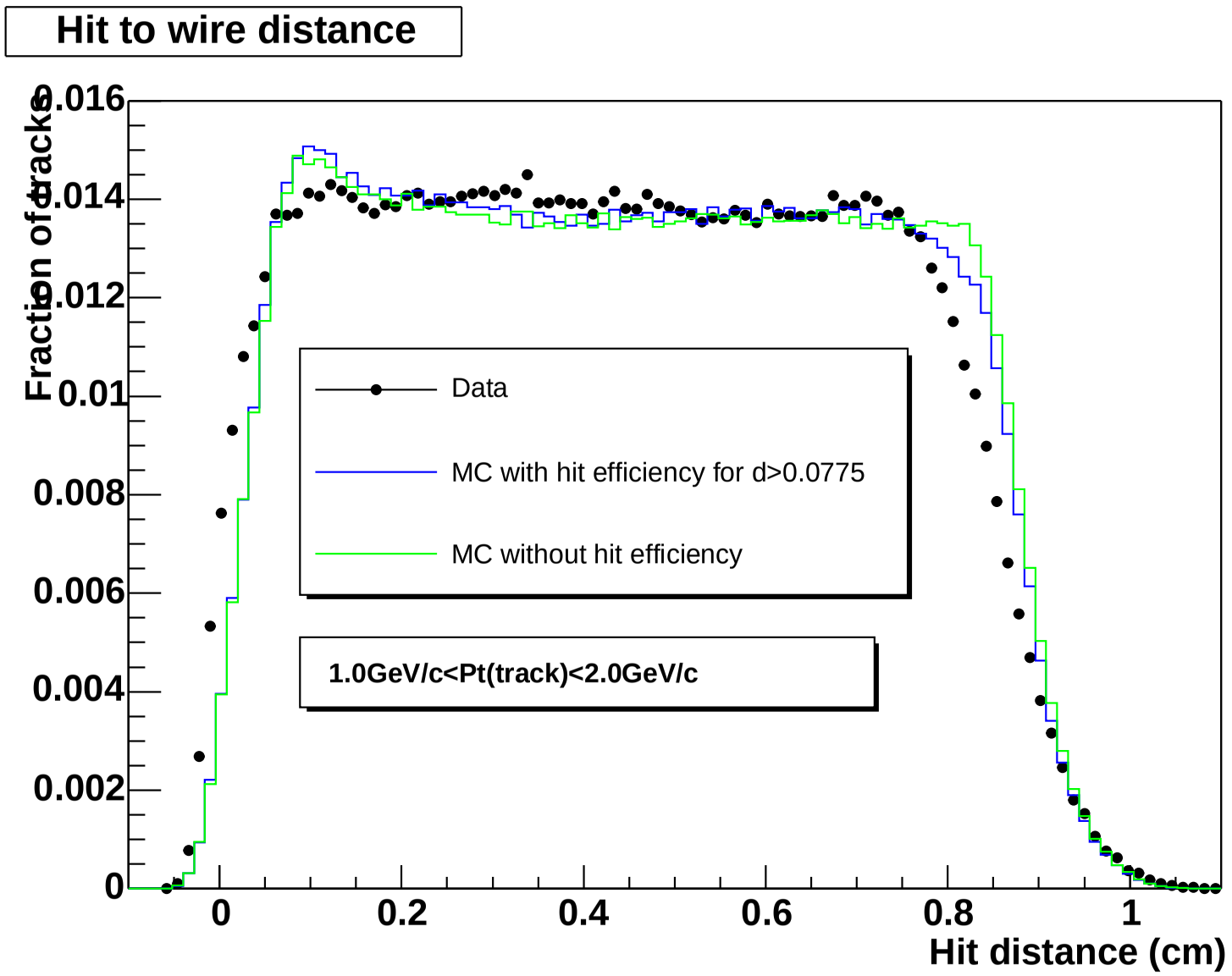
    SL1: 22.9/24 SL2: 23.1/24 SL3: 23/24 SL4: 23.3/24

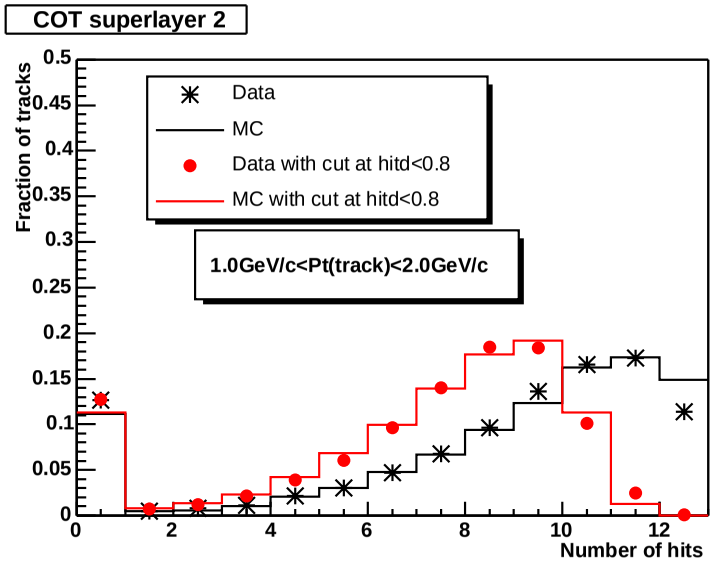
    SL5: 23.4/24 SL6: 23.4/24 SL7: 23.3/24 SL8: 23.3/24

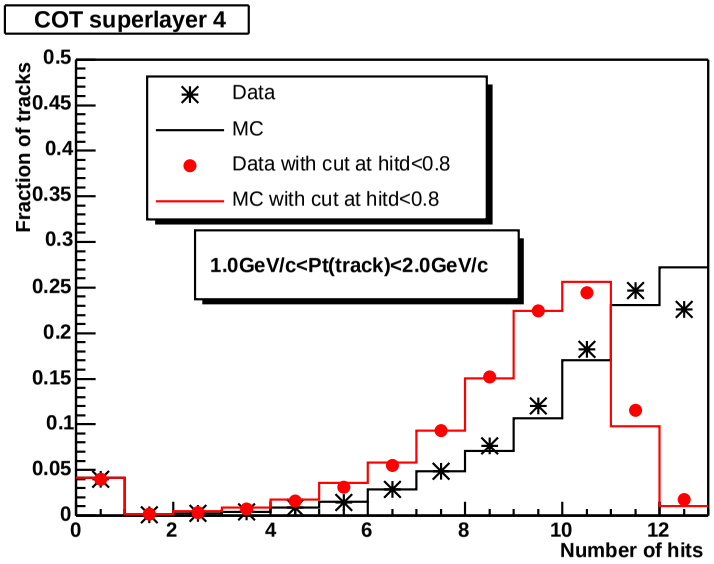
    $\Rightarrow$ Denominator: Hit efficiency while reconstructing a fake track: $\sim 99\%$ for all super layers

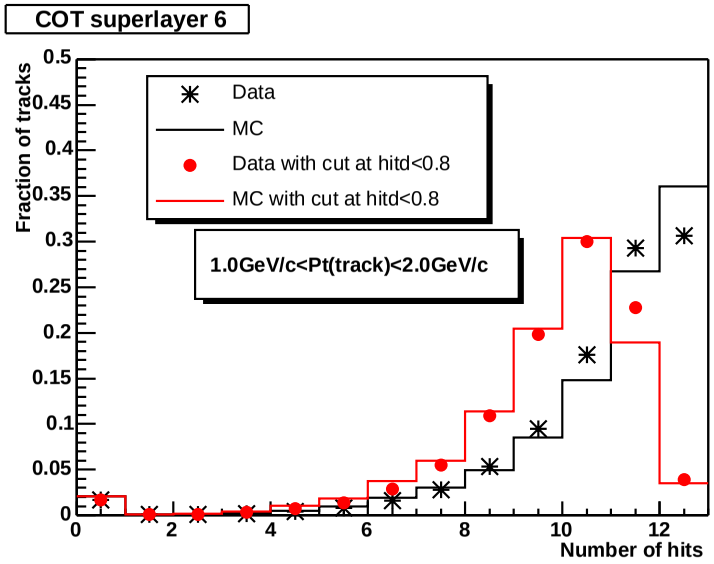
    $\Rightarrow$ Make cut a function of drift distance: apply cut only at $hitD > 0.775cm$

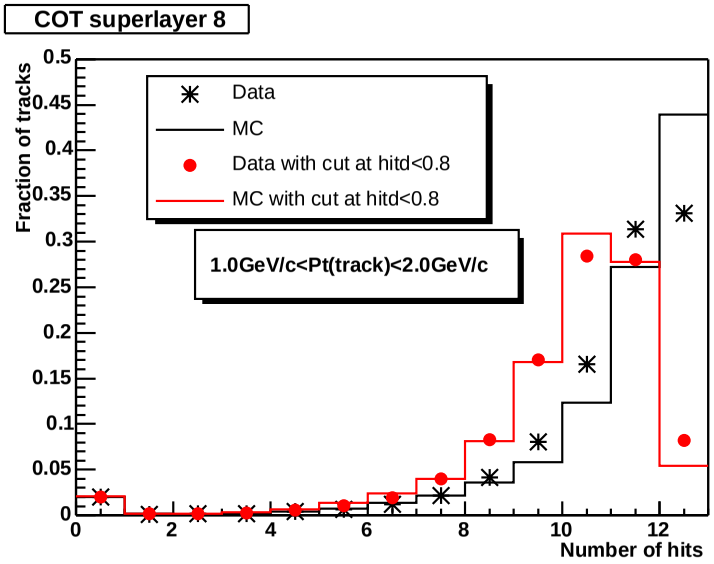
- For both data and MC, use track in 0.4 cone from highest p_t vertex
- Distribution of the track hit residual (smearing scale factor 0.8)
- Distribution of hit width (Penn drift model)

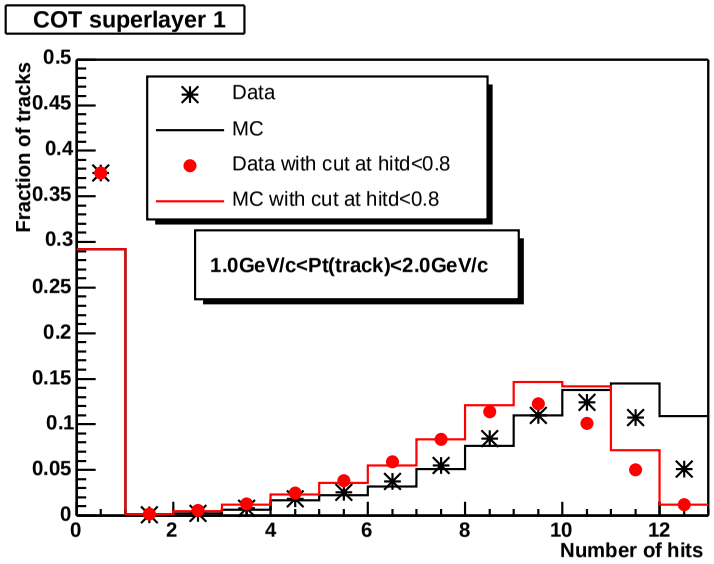

Hit to wire distance
Fraction of tracks
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
0
0.2
0.4
0.6
0.8
1
Hit distance (cm)
Data
MC with hit efficiency for d>0.0775
MC without hit efficiency
1.0GeV/c<Pt(track)<2.0GeV/c

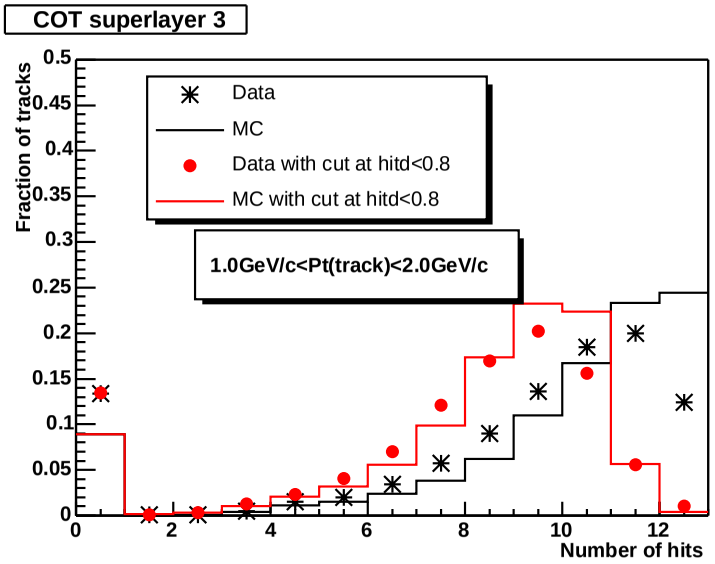

COT superlayer 2
Fraction of tracks
Number of hits
Data
MC
Data with cut at hitd<0.8
MC with cut at hitd<0.8
1.0GeV/c<Pt(track)<2.0GeV/c

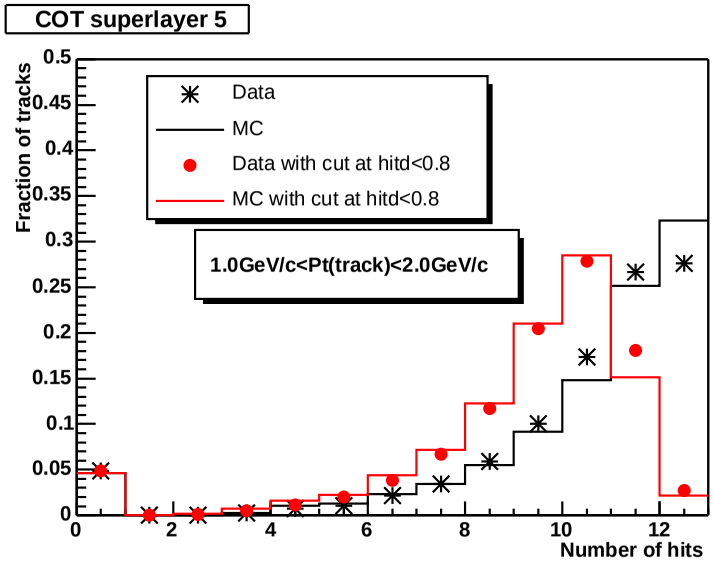

COT superlayer 4
Fraction of tracks
Number of hits
Data
MC
Data with cut at hitd<0.8
MC with cut at hitd<0.8
1.0GeV/c<Pt(track)<2.0GeV/c

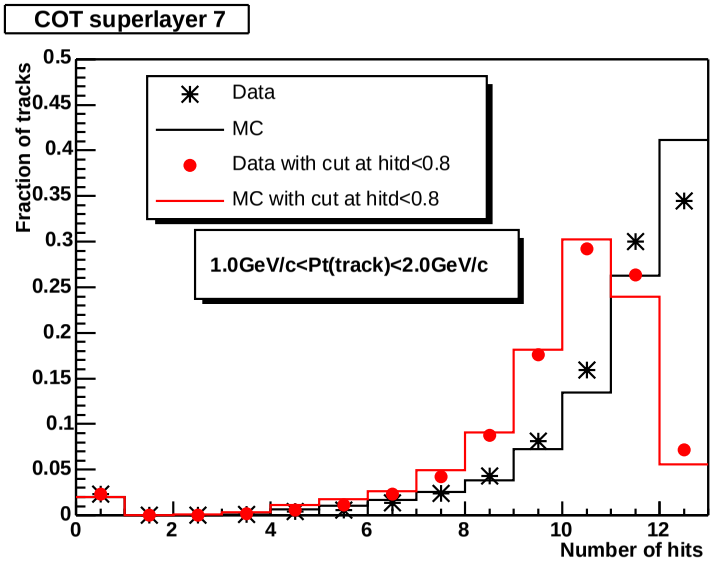

COT superlayer 6
Fraction of tracks
Number of hits
Data
MC
Data with cut at hitd<0.8
MC with cut at hitd<0.8
1.0GeV/c<Pt(track)<2.0GeV/c

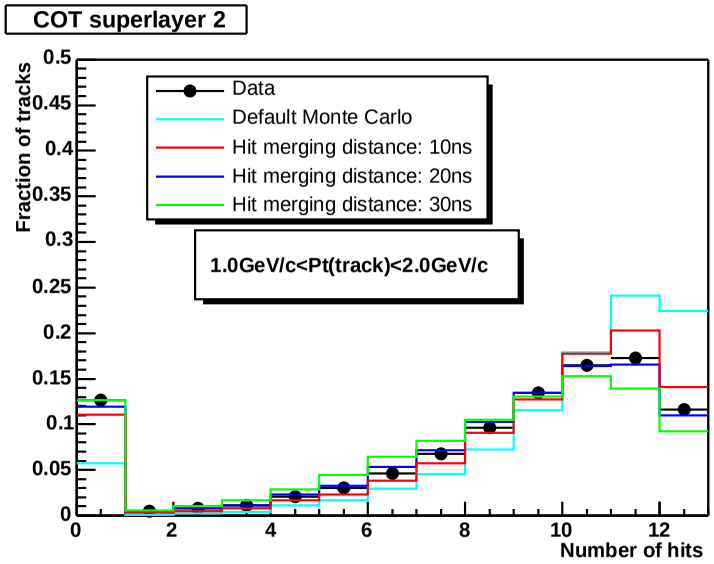

COT superlayer 8
Fraction of tracks
Number of hits
Data
MC
Data with cut at hitd<0.8
MC with cut at hitd<0.8
1.0GeV/c<Pt(track)<2.0GeV/c

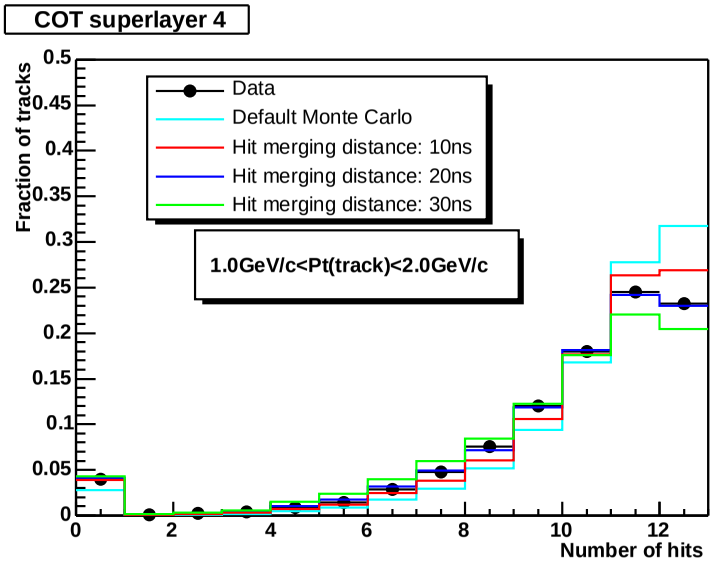

COT superlayer 1
Fraction of tracks
Number of hits
Data
MC
Data with cut at hitd<0.8
MC with cut at hitd<0.8
1.0GeV/c<Pt(track)<2.0GeV/c

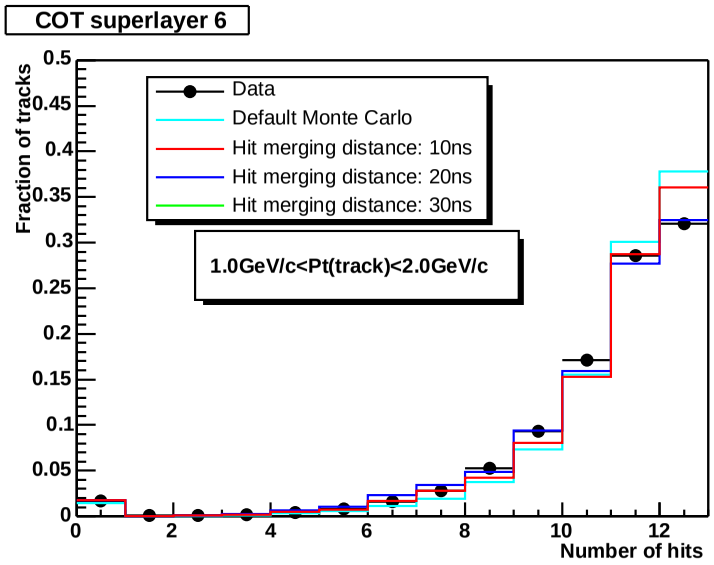

COT superlayer 3
Fraction of tracks
Number of hits
Data
MC
Data with cut at hitd<0.8
MC with cut at hitd<0.8
1.0GeV/c<Pt(track)<2.0GeV/c

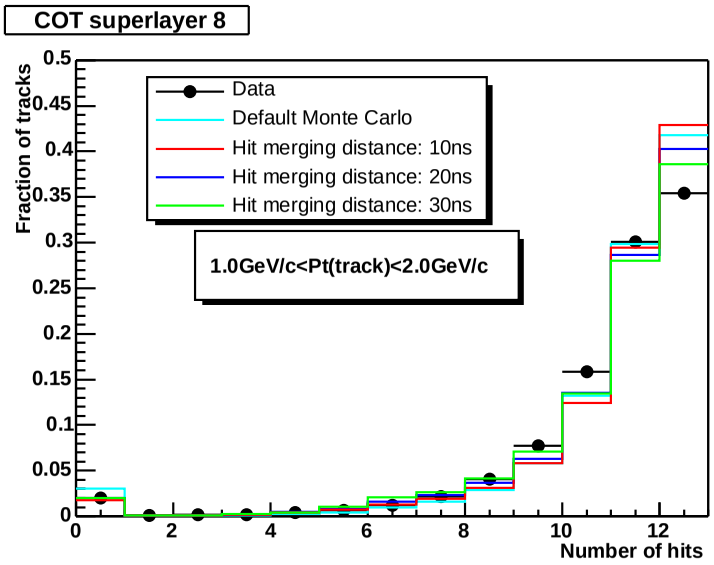

COT superlayer 5
Fraction of tracks
Number of hits
Data
MC
Data with cut at hitd<0.8
MC with cut at hitd<0.8
1.0GeV/c<Pt(track)<2.0GeV/c

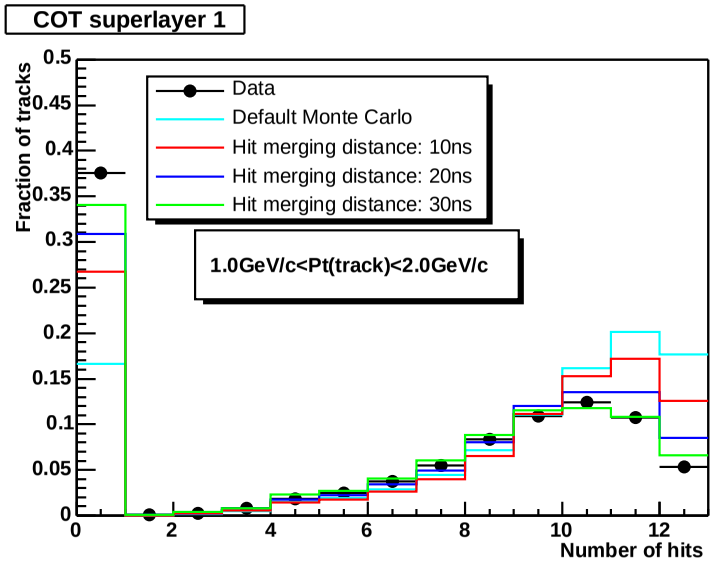

COT superlayer 7
Fraction of tracks
Number of hits
Data
MC
Data with cut at hitd<0.8
MC with cut at hitd<0.8
1.0GeV/c<Pt(track)<2.0GeV/c

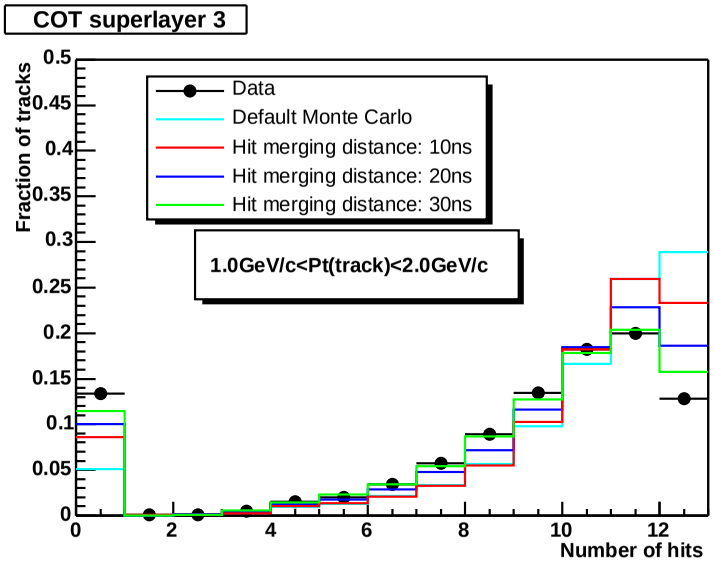

COT superlayer 2
Fraction of tracks
Number of hits
Data
Default Monte Carlo
Hit merging distance: 10ns
Hit merging distance: 20ns
Hit merging distance: 30ns
1.0GeV/c<Pt(track)<2.0GeV/c

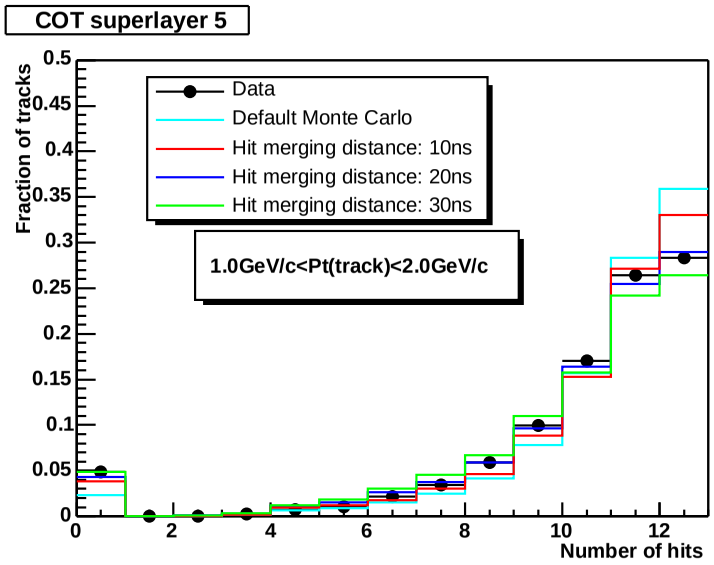

COT superlayer 4
Fraction of tracks
Number of hits
Data
Default Monte Carlo
Hit merging distance: 10ns
Hit merging distance: 20ns
Hit merging distance: 30ns
1.0GeV/c<Pt(track)<2.0GeV/c

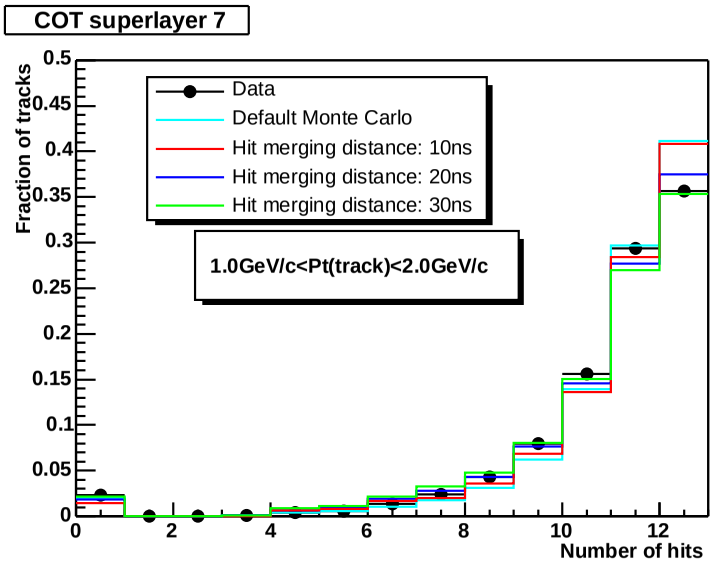

COT superlayer 6
Fraction of tracks
Number of hits
Data
Default Monte Carlo
Hit merging distance: 10ns
Hit merging distance: 20ns
Hit merging distance: 30ns
1.0GeV/c<Pt(track)<2.0GeV/c

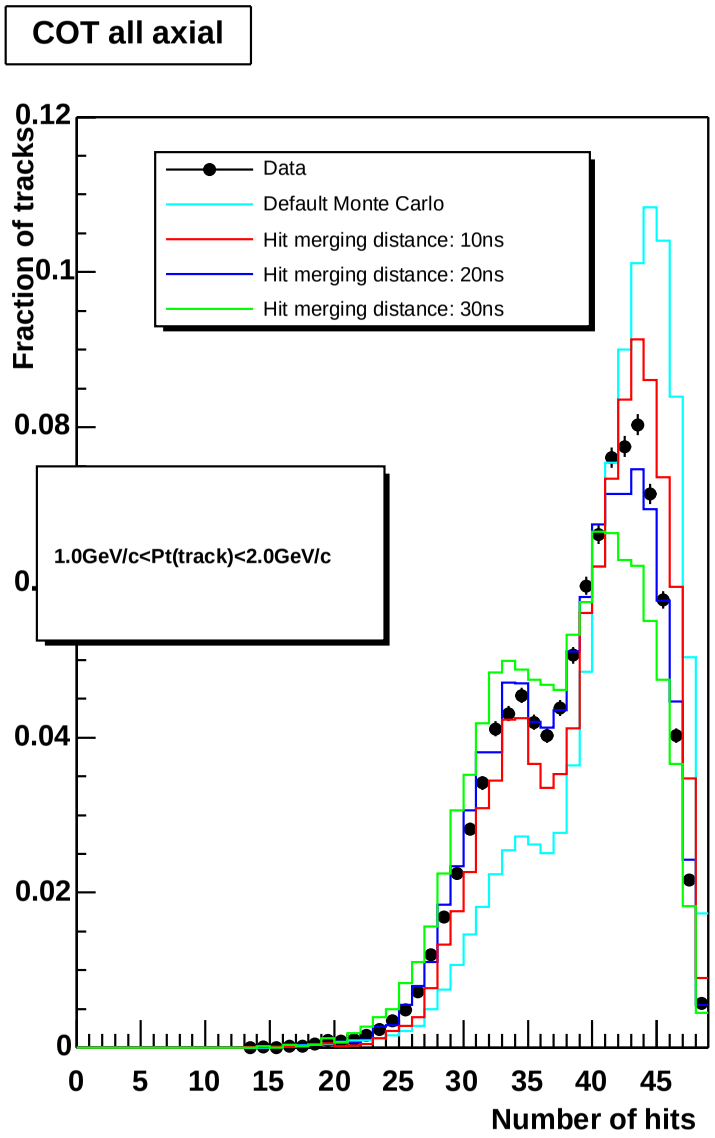

COT superlayer 8
Fraction of tracks
Number of hits
Data
Default Monte Carlo
Hit merging distance: 10ns
Hit merging distance: 20ns
Hit merging distance: 30ns
1.0GeV/c<Pt(track)<2.0GeV/c

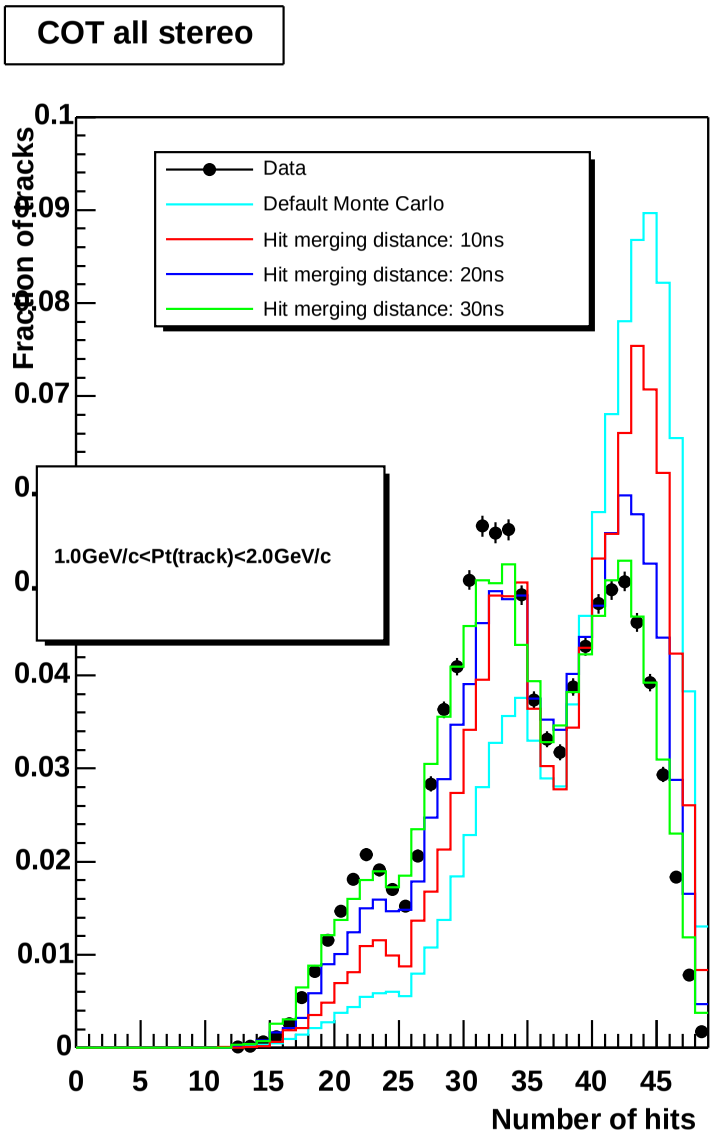

COT superlayer 1
Fraction of tracks
Number of hits
Data
Default Monte Carlo
Hit merging distance: 10ns
Hit merging distance: 20ns
Hit merging distance: 30ns
1.0GeV/c<Pt(track)<2.0GeV/c


COT superlayer 3
Fraction of tracks
Number of hits
Data
Default Monte Carlo
Hit merging distance: 10ns
Hit merging distance: 20ns
Hit merging distance: 30ns
1.0GeV/c<Pt(track)<2.0GeV/c


COT superlayer 5
Fraction of tracks
Number of hits
Data
Default Monte Carlo
Hit merging distance: 10ns
Hit merging distance: 20ns
Hit merging distance: 30ns
1.0GeV/c<Pt(track)<2.0GeV/c


COT superlayer 7
Fraction of tracks
Number of hits
Data
Default Monte Carlo
Hit merging distance: 10ns
Hit merging distance: 20ns
Hit merging distance: 30ns
1.0GeV/c<Pt(track)<2.0GeV/c


COT all axial
Fraction of tracks
Data
Default Monte Carlo
Hit merging distance: 10ns
Hit merging distance: 20ns
Hit merging distance: 30ns
1.0GeV/c<Pt(track)<2.0GeV/c
Number of hits


COT all stereo
Fraction of tracks
Data
Default Monte Carlo
Hit merging distance: 10ns
Hit merging distance: 20ns
Hit merging distance: 30ns
1.0GeV/c<Pt(track)<2.0GeV/c
Number of hits

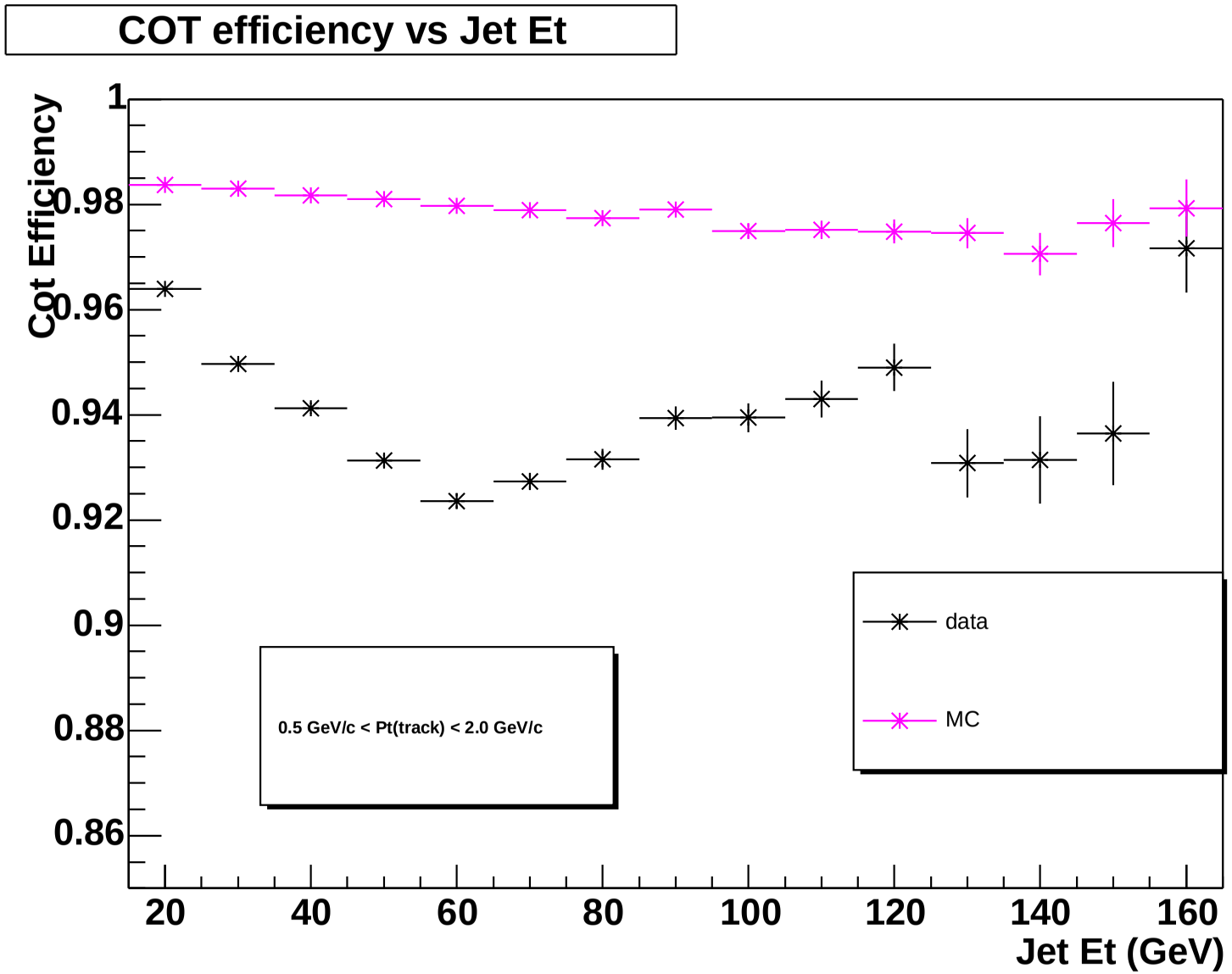
Definition of efficiency

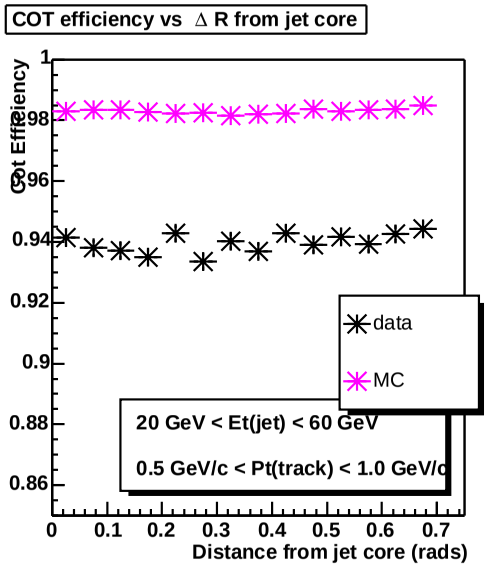
Denominator: the embedded track

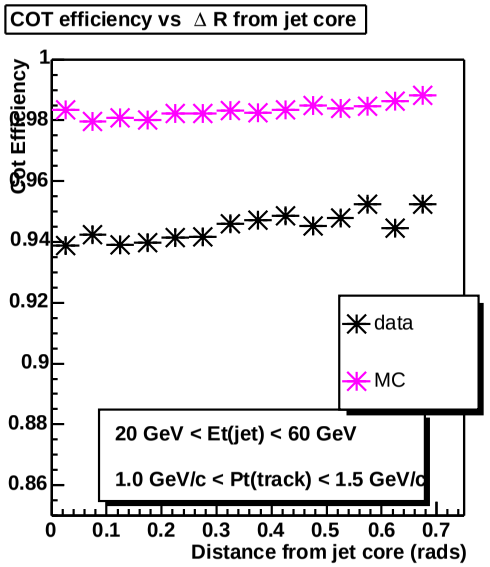
- Charged pions that don't have a decay (or interaction) vertex
- Random P_t from 0.5 to 2 GeV/c (will do higher p_T soon)
- Flat random angular distance from jet core between 0 to 0.7 rads
- COT fiducial ($|cotz| < 149cm$)

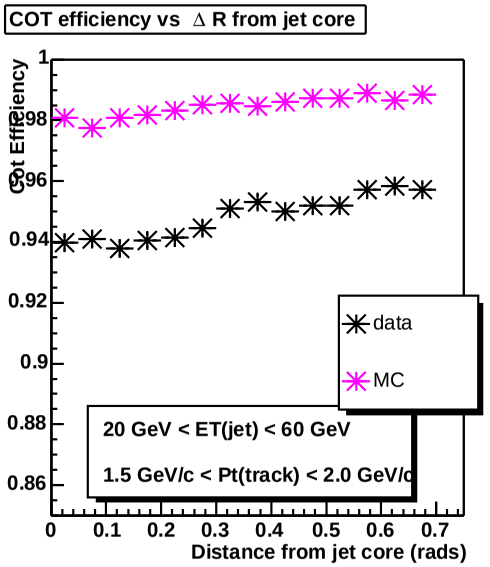
Numerator: BOTH criteria satisfied to compare OBSP helix and reconstructed tracks

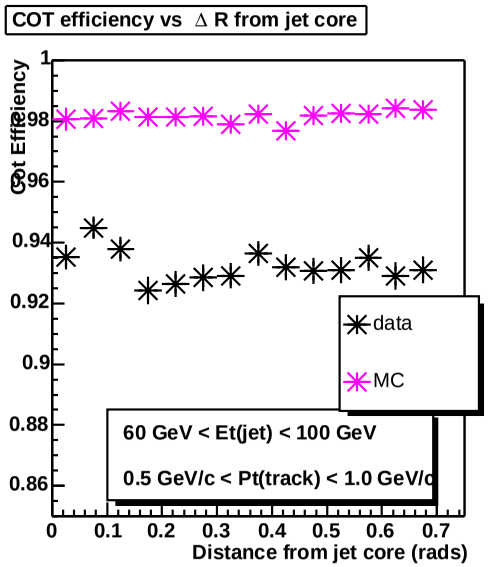
- At least 10 more hit match than any other track
- AND $\Delta d0 < 0.4$, $\Delta\Phi < 0.013$ and $\Delta curvature < 0.00004$

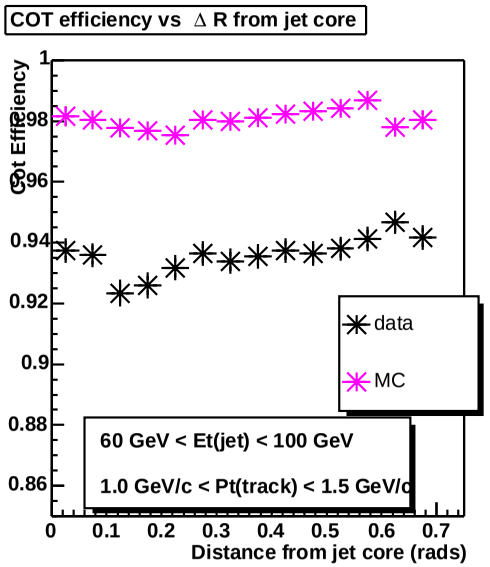

COT efficiency vs Jet Et
Cot Efficiency
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
20
40
60
80
100
120
140
160
Jet Et (GeV)
0.5 GeV/c < Pt(track) < 2.0 GeV/c
data
MC

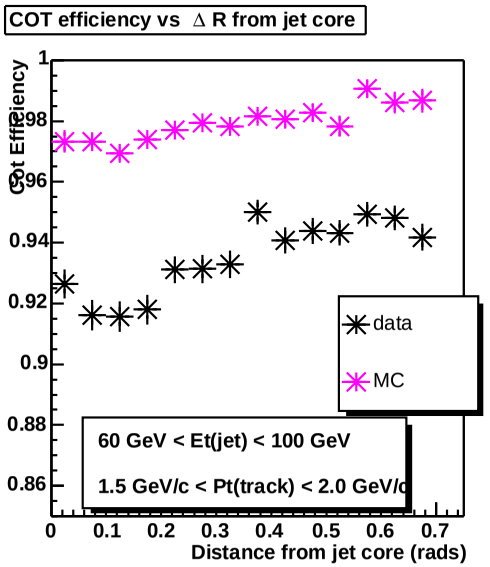

COT efficiency vs Δ R from jet core
Cot Efficiency
Distance from jet core (rads)
data
MC
20 GeV < Et(jet) < 60 GeV
0.5 GeV/c < Pt(track) < 1.0 GeV/c

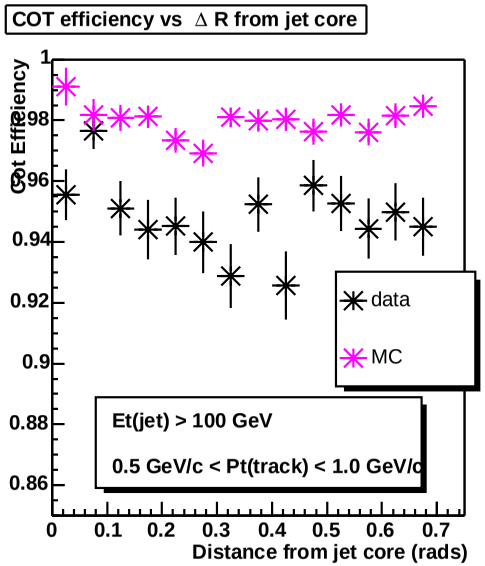

COT efficiency vs Δ R from jet core
Cot Efficiency
Distance from jet core (rads)
data
MC
20 GeV < Et(jet) < 60 GeV
1.0 GeV/c < Pt(track) < 1.5 GeV/c

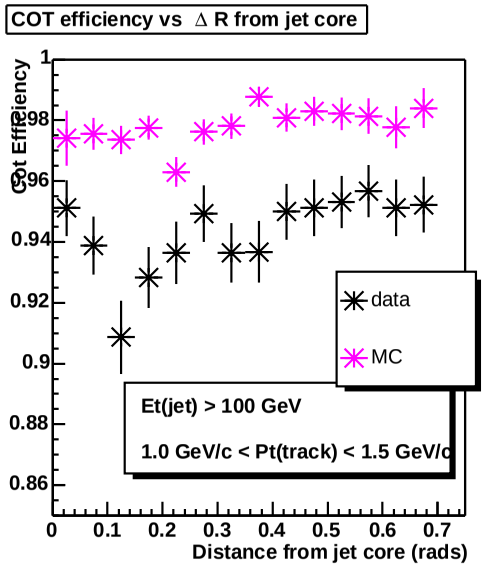

COT efficiency vs Δ R from jet core
Cot Efficiency
Distance from jet core (rads)
data
MC
20 GeV < ET(jet) < 60 GeV
1.5 GeV/c < Pt(track) < 2.0 GeV/c

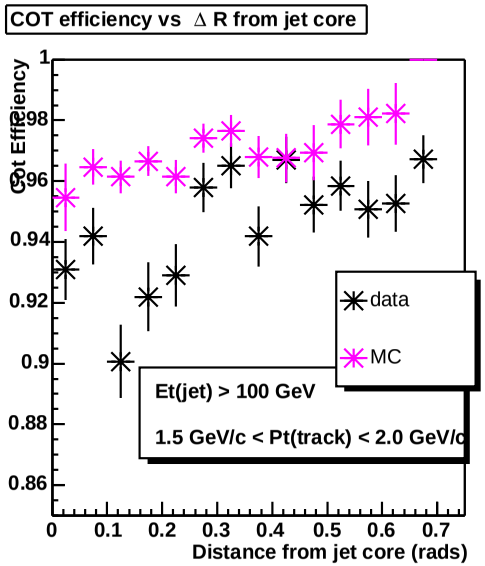

COT efficiency vs Δ R from jet core
Cot Efficiency
Distance from jet core (rads)
data
MC
60 GeV < Et(jet) < 100 GeV
0.5 GeV/c < Pt(track) < 1.0 GeV/c

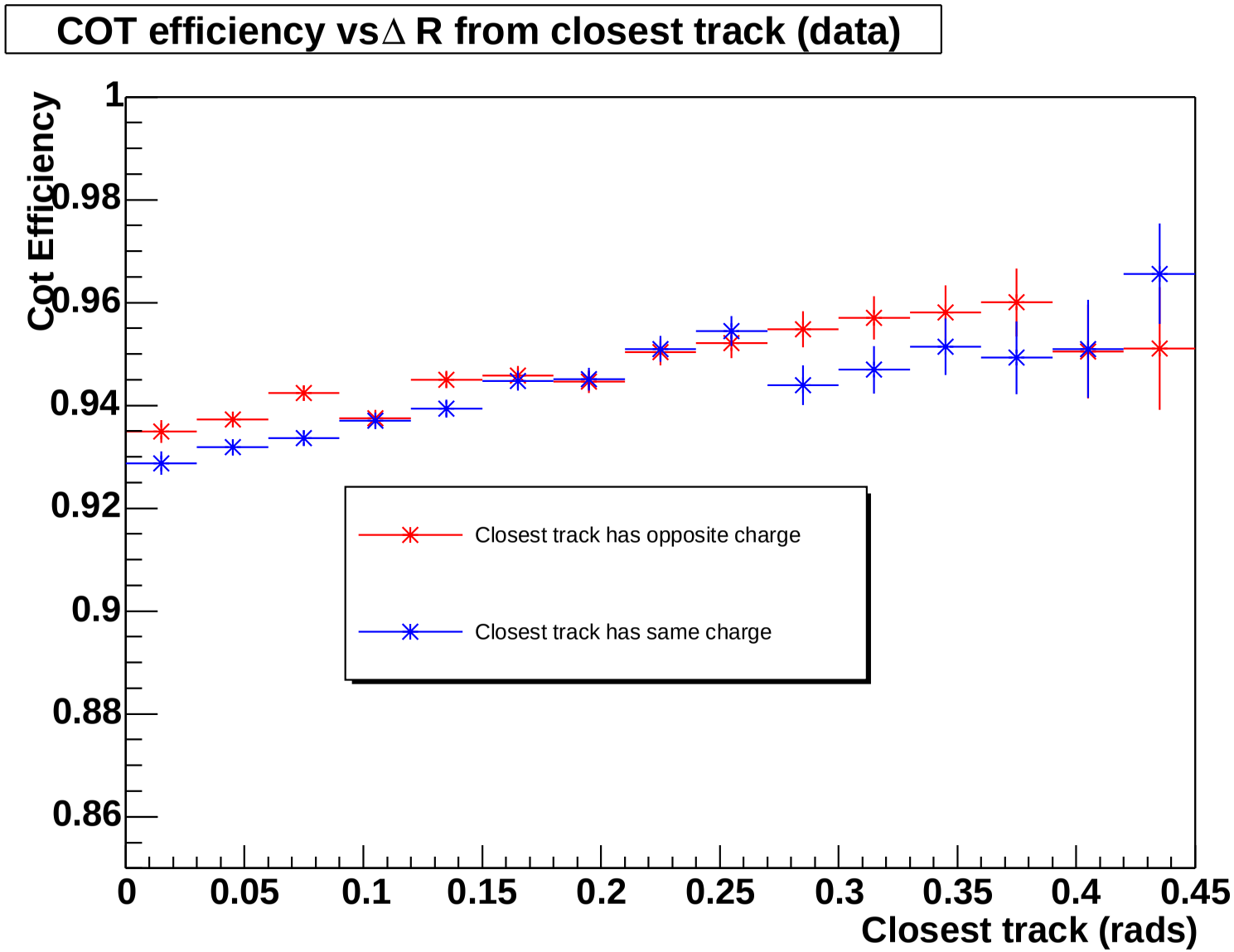

COT efficiency vs Δ R from jet core
Cot Efficiency
Distance from jet core (rads)
data
MC
60 GeV < Et(jet) < 100 GeV
1.0 GeV/c < Pt(track) < 1.5 GeV/c


COT efficiency vs Δ R from jet core
Cot Efficiency
Distance from jet core (rads)
data
MC
60 GeV < Et(jet) < 100 GeV
1.5 GeV/c < Pt(track) < 2.0 GeV/c


COT efficiency vs Δ R from jet core
Cot Efficiency
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Distance from jet core (rads)
data
MC
Et(jet) > 100 GeV
0.5 GeV/c < Pt(track) < 1.0 GeV/c


COT efficiency vs Δ R from jet core
Cot Efficiency
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Distance from jet core (rads)
data
MC
Et(jet) > 100 GeV
1.0 GeV/c < Pt(track) < 1.5 GeV/c


COT efficiency vs Δ R from jet core
Cot Efficiency
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Distance from jet core (rads)
data
MC
Et(jet) > 100 GeV
1.5 GeV/c < Pt(track) < 2.0 GeV/c


COT efficiency vs Δ R from closest track (data)
Cot Efficiency
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
Closest track (rads)
Closest track has opposite charge
Closest track has same charge

Plan

- Use newer tracking software version
- Use variable that defines number of immediately near hits
- Refine the track reconstruction criteria (error dependent criteria)
- Try hit efficiency, hit merging and Penn Drift Model for MC
- Compare track multiplicity in MC and data